Totally thoracoscopic pulmonary vein isolation a simplified technique

Al-Jazairi, Meelad I H ; Klinkenberg, Theo J ; Van Putte, Bart P ; Mariani, Massimo A ; Benussi, Stefano

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Totally Thoracoscopic Pulmonary Vein Isolation
A Simplified Technique

Meelad I.H. Al-Jazairi, MD, Theo J. Klinkenberg, MD,† Bart P. Van Putte, MD, PhD,‡§ Massimo A. Mariani, MD, PhD,† and Stefano Benussi, MD, PhD||*

Abstract: Since the introduction of thoracoscopic ablation for atrial fibrillation (AF), the field of minimally invasive AF treatment has evolved toward an established treatment option for AF, with an overall 2-year antiarrhythmic drug free success rate of 77%. Complications are usually minor, and the incidence of bleeding needing conversion to sternotomy or (mini-)thoracotomy varies between 0% and 1.6%. Bleeding is often related to encircling the pulmonary veins, which is a blind maneuver that has to be done without direct camera vision. We propose here a modified surgical technique to simplify the procedure, shorten the operating time, and lower the risk of complications.

Key Words: Atrial fibrillation, Minimally invasive surgery, Surgical ablation, Pulmonary vein isolation, Thoracoscopic procedures.

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Since the introduction of thoracoscopic ablation for the treatment of atrial fibrillation (AF) in 2003 by Saltman et al,[1] the field of minimally invasive standalone AF treatment has evolved toward an established treatment option for AF with a class 2a indication according the 2016 European Society of Cardiology guidelines.[2] Energy source, lesion sets, and surgical techniques have changed during this evolution period resulting in an overall 2-year antiarrhythmic drug free success rate of 77%.[3] Complications described are usually minor and the incidence of bleeding needing conversion to sternotomy or (mini-)thoracotomy varies between 0% and 1.6%.[2] Bleeding is often related to encircling the pulmonary veins (PVs), which is a blind maneuver that has to be done without direct camera vision. In this report, we propose a modified surgical technique to simplify the procedure resulting in a shorter operating time and lower risk of complications.

Video clip is available online.

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From the *Department of Cardiology, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands; †Department of Cardiothoracic Surgery, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands; ‡Department of Cardiovascular Surgery, St. Antonius Hospital, Nieuwegein, The Netherlands; §Department of Cardiovascular Surgery, Academic Medical Center, Amsterdam, The Netherlands; and ||Department of Cardiovascular Surgery, University Hospital Zurich, Zurich, Switzerland.

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Address correspondence and reprint requests to Massimo A. Mariani, MD, PhD, Department of Cardiothoracic Surgery, University Medical Center Groningen, Hanzeplein 1, 9700 RB Groningen, The Netherlands. E-mail: m.mariani@umcg.nl.

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TECHNIQUE

The right-sided procedure is carried out according to the standard technique that has been described before.[4] Briefly, after the introduction of three thoracoports, the pericardium is opened anterior to the phrenic nerve. The transverse sinus and the oblique sinus are opened by blunt dissection. A rubber band is guided by a tracklight dissector (Lumitip, AtriCure Inc, West Chester, OH USA) around the right PVs from the oblique sinus to the transverse sinus. This is done as much away from the right PVs as possible, with the exit point of the Lumitip dissector surfacing as far as possible from the right PVs, usually about midway between the left and right superior PVs. The rubber band is then fixed to a bipolar ablation device (Isolator Synerg Clamp, AtriCure Inc) and introduced into the chest cavity. The bipolar clamp is opened and guided around the antrum of the right PVs by the rubber band. The clamp is then closed and the antrum including the PVs is ablated. After PV isolation, the clamp is extracted from the chest, but the rubber band (Glidepath Soft Guide, AtriCure Inc) is left around the PVs. The rubber band is then cut from the clamp, which might then be inserted into the chest cavity again for the ablation of the superior caval vein. The right-sided ablation is completed by the ablation of the right half of the superior and inferior lines of the posterior box of the left atrium, using a bipolar radiofrequency device (Coolrail Linear Pen, AtriCure Inc).

MODIFICATION

Instead of retrieving the clamp and the rubber band from the chest cavity after right PV isolation, the rubber band is left in position around the right PVs. The clamp is removed from the chest cavity. The connection between the clamp and the rubber band is cut just outside the thorax and the end of the rubber band is pushed back inside (Fig. 1, step 1). The rubber band is now still in position around the right PVs. The end of the rubber band coming out from the oblique sinus is then held by a forceps and pushed deeper leftward into the oblique sinus (Fig. 1, steps 2–3). The other end of

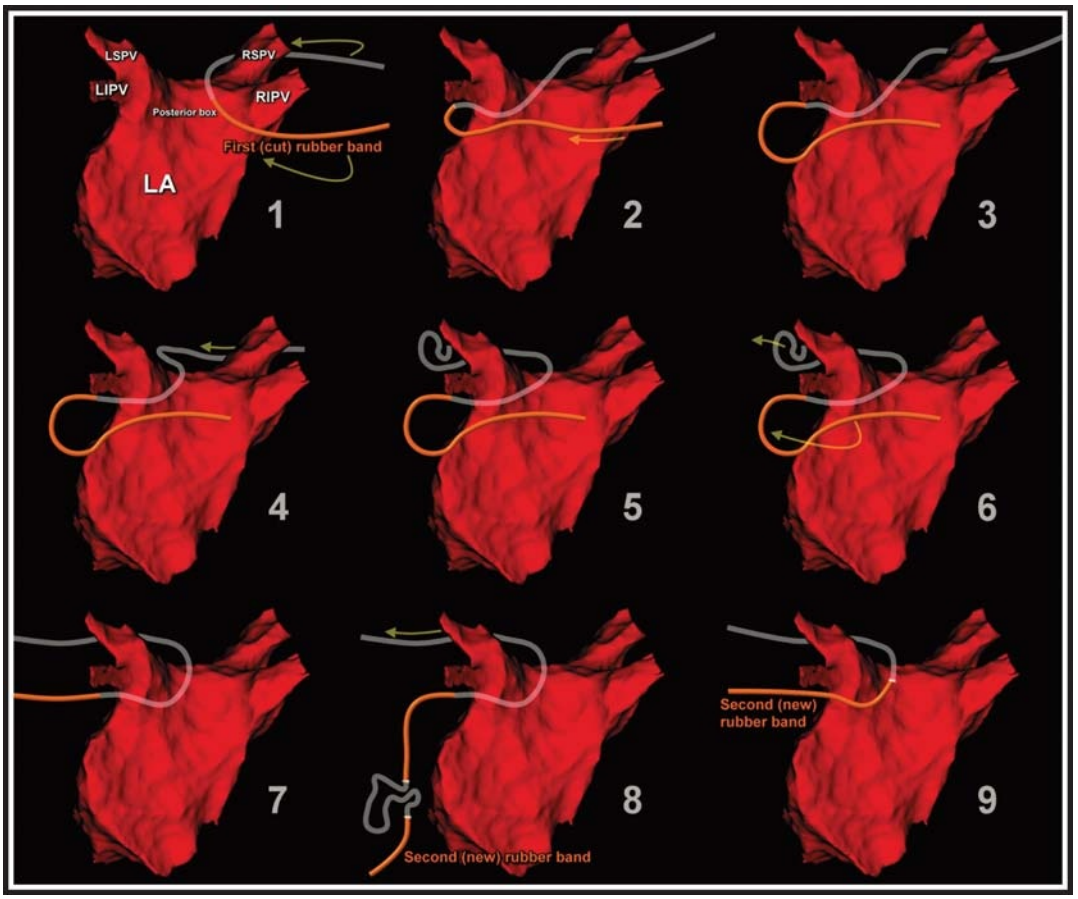

FIGURE 1. Step-by-step diagram explaining the technique (1–9).

the rubber band coming out from the transverse sinus is likewise pushed between the ostium of the inferior vena cava and into the transverse sinus, until it is not in sight any more (Fig. 1, steps 4–5). The pericardium is approximated and a pleural drain is left.

After introduction of three thoracoports on the left side, the rubber band, which was left behind in the oblique sinus, can easily be identified through the pericardium (Fig. 2A). The pericardium is then opened (most frequently, the cut red rubber band can enhance left pericardial opening as it shields the heart from the cautery) and the ends of the rubber band that were left behind are pulled out from the oblique and transverse sinuses on the left side (Fig. 1, steps 6–7; Figs. 2B, C; see also Video, Supplemental Digital Content, http://links.lww.com/INNOV/A152).

First, the plastic end of the Glidepath band coming out of the transverse sinus is invariably found at the cranial end of the

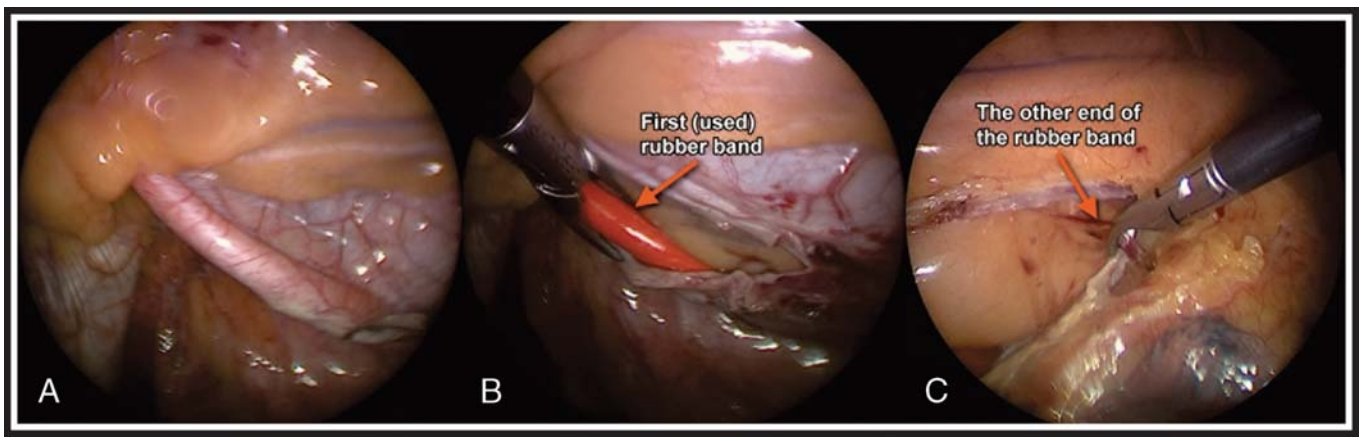

FIGURE 2. Opening the pericardium and pulling both ends of the rubber band from the left side. The rubber band is now encircling the antrum of the left PVs.

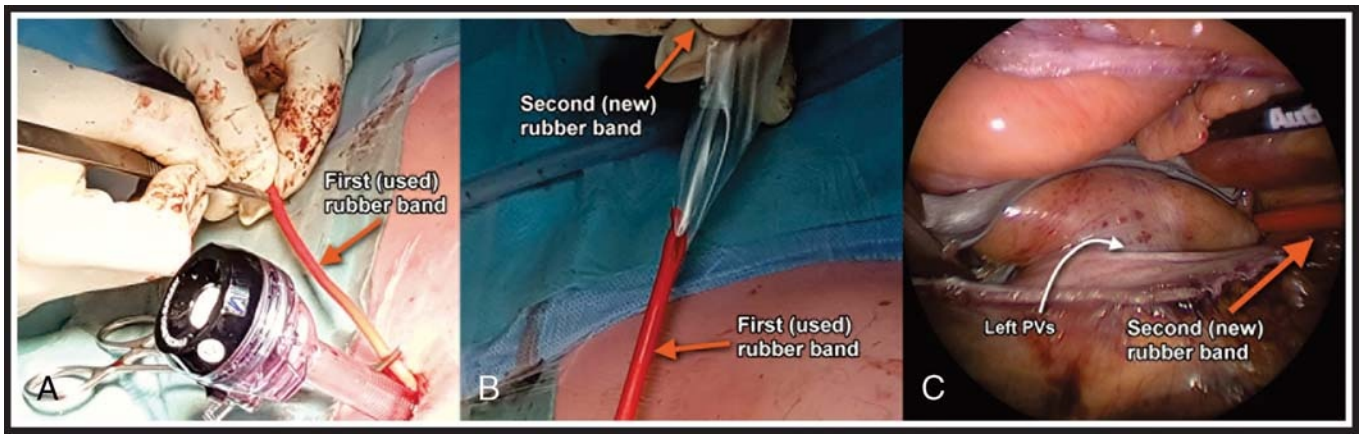

FIGURE 3. The connection of the two rubber bands (the used rubber band and the new one) and the ablation of the left PVs.

left pericardial incision, just about the superior left PV. It is easily pulled outside via the upper trocar.

Next, the lower end of the rubber band coming out of the oblique sinus is pulled out of the thorax through the lower left port opening and connected to a new rubber band (Figs. 3A, B).

By pulling the upper end of the first rubber band out of the upper port opening, the new rubber band falls smoothly in position around the left PVs through the same dissection tunnel, which was created by the Lumitip dissector on the right side (Fig. 1, steps 8–9). Thus, the first rubber band (used on the right side) is now functioning as a guide for the new rubber band (on the left side). The encirclement of the left PVs by a Lumitip dissector is therefore not necessary anymore because the same tunnel that was created with the Lumitip dissector from the right side is used. The new rubber band is then connected to the clamp on the left side (the first rubber band is already cut and therefore cannot be connected to the clamp, hence the need for a new rubber band).

The procedure then proceeds in the same way as in the standard technique, by closing the pericardium and the left-sided ports.

Next to this technical simplification, this approach also ensures that the position of the clamp on the left side will be close to its position on the right side, because the isolation line of the left PVs will be more antral (Fig. 3C). In most cases, "kissing" PV isolation lines from left and right side are achieved by this modification. Therefore, an additional roofline made by a unidirectional pen device is probably not necessary anymore in most cases.

COMMENTS

This modification in the surgical technique has the following three potential advantages:

1. Increased safety: The simplified technique would involve less invasive dissection and thus reduce consistently the risk of complications.
2. Increased efficiency: Procedure time will be shorter because there is no need for additional dissection to create another tunnel on the left side.
3. Increased efficacy: By enhancing the possibility of performing kissing PV isolation lines with the bipolar radiofrequency clamp, the proposed technique could result in larger initial posterior box isolation. Furthermore, the roof connection between the PV encircling makes it more reliably transmural and more likely to last in time than that achieved with linear nonclamping devices.[5] Because of this, connecting the two PV encircling ablation lines can actually turn into better AF ablation efficacy and at the same time can help prevent the most feared postablation tachycardias related to reentries across gaps in the connecting ablation lines.

However, future research is still needed to investigate these potential advantages.

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